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Item 7 (b) of the provisional agenda*
Reports on achievements in surveying, mapping and charting in addressing national, subregional, regional and global issues, including technical issues

Geotechnologies for Global Development

Submitted by the Spanish Society of Cartography, Photogrammetry and Remote Sensing**

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GEOTECHNOLOGIES FOR GLOBAL DEVELOPMENT

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1.-Information Society and Geotechnologies.

During the last decade there has been a highly growing transformation and technological change process, which has led to substitute the "industrial society" notion for the one related to the "information society". It is widely asserted that we are living in a new age in which the information technologies play a very relevant role as the driving force of the deep changes to be carried out within the social behaviors, the economic activity and the employment.

Until the 90's, new technologies, since then known as information technologies, were commonly used on the task and production process automation, without leading to a significant change within the economic and social patterns. However, during the most recent years three new incidents cause a deep social transformation, and actually direct us into the "information society". First of all, **multimedia** products are introduced and widely spread amongst consumers, which removes the bounders between the different levels of communication. Secondly there are **mobile** terminals, which help us to communicate in several ways anywhere on the Earth, outside our dwellings or places of work. Lastly, the **Internet** arises amongst users and becomes the most innovative tool for knowledge and information exchange ever known.

These technological changes, which I pointed out briefly , have a deep and positive effect within the geotechnology field. The remote sensing, the

global navigation and positioning satellite systems, the geographical information systems and, in a broad sense, the information technologies have contributed to a change in the work and research methods in geoinformation. At the same time, this change is also appreciable in specific areas such as industries, official bodies, research and educational institutions directly related to this science.

The technological development in these fields will dramatically grow in the following years. The new generation of satellite constellations for the Earth observation and the navigation will enhance the current performance regarding accuracy, availability and data quality. On the other hand, a joint use and management of the advantages offered by the remote sensing and the Global Navigation and Positioning Satellite Systems will place them in the avant-garde of the creation of land information. The description and transformation of the Earth geography through digital patterns, based on high-resolution graphics, with a huge data volume, will be very helpful as a referentiation support to databases managed by Geoinformation Systems. These databases will be extremely important for a sustainable development.

2.- Geotechnologies for territorial knowledge

In the 20th century significant improvements have been achieved regarding the development and exploitation of science and technology to meet human requirements. At the beginning of the new millenium, the world community faces many challenges concerning its sustainable development and the reliable environment management, as well as remarkable chances for the scientific and socioeconomic development. The advantages of the information society must reach the whole world population without any exception. Thus, it will give rise to the knowledge society. It is extremely

important to consider that globalization will only be successful if it can benefit the whole world population.

We face the increasing threats of natural disasters and rapid environmental changes, including climate warming and its effects, deforestation, desertification, and land degradation, ozone-depletion acid rain and a reduction in biodiversity. Such changes have an influence on people quality of life, as well as on the essential requirements to guarantee the human being survival anywhere on Earth.

Geotechnologies must help to solve these problems, about which there are still extremely important scientific controversies to reach a sustainable development. These challenges, dramatically showed on these matters, will set the criteria for development and will constitute a vital task for new technologies before the new millenium. Undoubtedly, geoinformation has become the touchstone to analyze all the events taking place on the surface of Earth and the changes produced on it by the effects of time. For these purposes, remote sensing techniques and continuous georeferentiated data retrieval will increasingly become essential and necessary tools.

The appropriate exploitation of the information retrieved through Earth observation from artificial satellites (orientated towards its natural resources, agriculture, huge forest areas, mining resorts and environment) will allow the public management heads to make satisfactory decisions, based on the actual state of every sector. Therefore, it will allow them to adopt policies leading to diminish the indefinite and negative effects over environment preservation and protection.

3.- Earth observation from outer space.

Nowadays, Earth observation satellites constitute an important and outstanding source of information related to inquiries based on the Earth system. Today, 45 Earth observation satellites have been launched. They provide relevant data to the different research fields dealing with space technology. In the next 15 years, 70 new missions will be carried out to launch 230 analysis and Earth surveillance appliances.

The data retrieval with passive systems -that is to say, those that register the solar radiation reflected on land- began in the seventies when the North-American satellite TIROS-1 was launched. In 1972, after the launch of the satellite Landsat 1, it was achieved an 80 meter resolution. In 1982 the Thematic Mapper sensor joined the Landsat 4, and 29-meter resolutions were achieved. Later, in 1986, the French satellite Spot was launched and, subsequently, a 10-meter panchromatic resolution was obtained. Since 1988, the Indian satellite IRS provides a 6-meter resolution.

On the other hand, it is convenient to expound the development of radar systems, categorized as active due to their radiation transmission and subsequent measurement of the response reflected on land. These radar systems were successfully applied from year 1995, after the launch of the Canadian satellite Radarsat, which featured a 25-meter resolution in both terrestrial and oceanic coats, under any weather condition, day and night. A very interesting feature for areas that remain overcast for almost the whole year.

In next three years a new high-resolution satellite generation will become an innovative data source, mainly aimed at business projects. The satellites' resolution will be from 0,8 to 5 meters on the panchromatic band and from

3,3 to 20 meters on other multispectral bands. Conversely, the new Radarsat's resolution will be 3 meter.

Thanks to the information provided by these satellites and its high resolution capability, many data will be obtained from: the Earth coat, the delimitation of the different units involving the landscape, the accurate interpretation of its nature and contents, as well as the geographical coordinates indicating its geographical position. This is a very valuable information, since it can be used as a powerful device to research into agricultural and forest matters, natural resources and environment status. On the other hand, since it can referentiate that large amount of information on chart databases, by using three-dimensional patterns, it constitutes a very reliable tool as a document or a working bench for studies and researches related to Geography.

On the geotechnology field it is easy to identify, with high accuracy, ten different types of basic data that will allow to be jointly exploited in order to approach the problems arising from the sustainable development and the environment preservation within a global scope. These types define the topography, the land use, the air quality, the subterranean and superficial water quality, the climatology, the demography, the hydrology, the infrastructures, and the economic and geological production.

4.- Global Positioning Systems

The experience attained during the last twenty years on the usage of the U.S.A. Global Positioning Systems –GPS- shows a high level of performance on geodesy, cartography, topography, and within the fields of transport, vehicle and individual localization, agriculture, oceanography, meteorology, geology and research and people rescue operations.

Therefore, GPS has become the best system to provide geographical data, coordinates of any point on Earth and the subsequent and accurate identification of the land features.

Regarding its current and future applications, it is necessary to consider the evolution of positioning systems towards Global Navigation Satellite Systems, which nowadays are internationally known as GNSS. The European Union, by means of the Council's Resolution -December 1994- on the contribution to the development of a global navigation satellite system, started a European policy that leaded in 1998 to the adoption of a Communication of the Transport Council on GNSS Strategy. In 1994, two consecutive phases were defined: the first one known as GNSS-1 or EGNOS, which enhanced or increased the performance of the existing constellations and the second one, known as GNSS-2 or Galileo, which created a new European satellite constellation.

The first phase is called EGNOS. The system architecture was designed in order to complement or increase the performance of the American GPS System and of the Russian GLONASS, so that the signal ensured its integrity, accuracy, availability and continuity, necessary for the different means of transport.

It is developed together with similar initiatives in the USA and Japan. Thus, three big areas of the world will be covered by similar augmentation systems: the American WAAS, which will fully operate in 2002; the Japanese MSAS and the European EGNOS, which will operate in 2003.

It can be confirmed without any doubt that, during 1999, the European Union developed a very important activity to promote, as a political

priority, the Galileo project. In February, the Commission's Communication on Galileo -"The participation of Europe in a new generation of satellite navigation services"- was approved and, therefore, the essential criteria and guidelines that must inspire Galileo were set down. In June, the Transport Council approved the Resolution that started the Galileo definition phase, which must be carried out together with the European Space Agency. In December 2000, the European Union finally approved the launching of the Galileo project.

The Resolution approving the definition phase of Galileo establishes an ambitious goal regarding the system exploitation, the implementation of a multimode infrastructure for the different means of transport -air, land and maritime- as a support of an integrated transport system. The above mentioned goal intends to enhance the safety and to reduce the problems taking place nowadays, especially, the flow of traffic, thus leading to a decrease of air pollution generated under the current congestion conditions, by means of the usage of alternative routes arising from the continuous knowledge of the situation.

Should not the European Union take this initiative, our industrial sector would become deeply weak and could not participate in the associated technological development nor compete within the world-wide market of about four thousand million dollars in 2005. GALILEO will make Europe have the duly market share and the relevant creation of employment. This will provide the space sector enterprises with the capacity to deal with advanced projects in future applications and, to participate actively in the definition and implementation of space and land systems of the new satellite constellation.

The remarkable technological evolution that will take place in the satellite navigation sector has an essential meaning in its aspect of a new homogeneous infrastructure of global information, which constitutes a reference point as a geographical information global infrastructure. This evolution also involves a new performance in the geographical positioning accuracy and in the air, land and sea navigation, along with complementary applications such as the universal implementation of time exact access system.

5.-Geographical Information Systems.

This is the scope where the collection of land information in the first decade of 2000 is focused on. Specific projects in the remote sensing and satellite navigation fields will determine the essential benchmark for the geographical knowledge. Thus, it will be possible to collect huge volumes of digital data regarding the events occurring in the Earth surface. This also involves a clear challenge that will be expressed in the capacity of turning this data into useful information for the different users.

The USA Vice-President's speech on The Digital Earth expressed this worrying by referring to the Landsat programme. This programme allowed us to take complete images of the Earth every two weeks during the last 20 years, though most of these images have never been used and remained stored in electronic silos with no other usage.

This situation can only be overcome by means of a general use of the geographical information systems. This will be transformed into the storage support and georeferentiated data management systems. Moreover, it will be also transformed into the presentation instrument of information in the required form for the different users of the multiple sectors in which the

human activity has, as a unique and main reference, the territory where they live together.

The geographical information systems are defined as the essential instruments for the organisation, treatment and integration of data by means of the appropriate algorithms and the product generation in the most suitable format and presentation for every work area. Their future is linked to that one of the information technologies; the dramatic advance in these technologies will also enhance important changes and bigger potentialities in the SIG.

On this matter, the geographical information systems consist of vital instruments for the integration of data obtained by different sources, thanks to the application of the appropriate algorithms that produce exits and a more suitable performance to the specific necessities of the target users.

An important value in the future regarding the usage of the SIG is the capacity it has to deal with different data, contents and formats and allows a wide flexibility when treating them. This usage also permits to integrate the data above and to show them with possible alternatives adjusted to the established requirements. On the other hand, a progressive growing of added value products will take place where their contents will provide very high levels of information compared to those levels of the starting databases.

6.- Public Policies for the management of basic land data.

In their global perspective, the information infrastructures have turned into a vital element for the development of countries. On a international level, the concept of global infrastructure of information is being discussed on the

basis of the real possibility of open connection and public access to the information. That different national government and international organisations are becoming aware of the conceptual change that is occurring with the general implementation of the information society, since the public administrations, from their national and global point of view, are the main sources of information.

The Public Administration produces information in order to develop its own competence, that is, the information needed for the political management and economic planning. These data cover every area of activity, socio-economic statistical and industry data and also, demographic, geographical, geological, hydrographic, Land Registry, estate property data, which allow to know the reality of the different territories. Nowadays, this information is also necessary for the entrepreneurial management that must be based on the territorial knowledge and on its basic georeferentiated data, as supporting elements for the enterprise decisions.

According to the European Commission, 80% of the current available databases can be geographically referred to. On the other hand, the number of digital geographical databases is growing exponentially in the developed countries and adopting new forms of expression in which both vectorial and raster data are complementary by means of video and audio information. The applied technology advancement allows to obtain dynamic multimedia representations, which along with the usage of maps, images and digital models, shows the changes occurred in geography during the years and overcomes the fixed and traditional graphic view.

Nowadays different long and short-term prospective exercises take place in order to situate the geographical information systems in their coming future. For that purpose, it is convenient to deepen those aspects related to their administrative support and work guidelines that must be established and to their integration in the national institutions responsible for the production and treatment of the basic land data. The training of experts in this field will constitute an indispensable condition so that these institutions could carry out their own responsibilities. Thus, they will independently value which are the most appropriate technological resources to create their own basic infrastructures of geographical information, without rejecting their wished capacity and decision independence.

Regarding this subject, the most urgent task is the definition of public policies that contribute to develop the usage of geotechnologies. They must help to solve the problems emerging from the different sectors of society, by means of an approach that envisages the more and more necessary collaboration of the public and private entrepreneurial sector. It is also necessary to facilitate the conditions in which any citizen or organisation can access the data and produced by the public sector from institutions specialising in geoinformation.

7. Geotechnologies in the XXI Century.

During this century, the exploration of the earth surface has been completed. There are neither territories nor continents to be discovered, since man knows the most isolated places, mountaintops, rivers, plateaux, glaciers and deserts and has already mapped them and revealed their form and dimensions. It might seemed that it is the end of the great geographical adventure of the mankind, but it is now when modern space technologies provide us with new and advanced instruments in order to continue the task

that goes to the geographical science. A new phase, in which it is not enough to know the most important traits of the earth surface, is opened. It is advisable to define it digitally and to reveal the multiple and difficult inter-relationships existing amongst the human beings and the environment they live in.

The information was firstly obtained by measuring every plot of land with simple topographic instruments and, afterwards, thanks to air pictures, different topographic models become available. It was not necessary anymore to cover every meter of the territory in a process where the point of view for the taking of data moved away from the own plot of land. First it was used a compass situated in the earth and then a camera in an aircraft. Nowadays, the sensors used for this purpose are situated in the space, in satellites, very remote from the plot of land, and, at the same time, they are able to offer a metric vision of the places we live in.

In the complex society of the future, geotechnologies, supported by new equipment generations and systems that will allow us to continue the knowledge adventure, will hold a vital role. The geotechnologies contribution will be indispensable in order to improve population's quality of life, the environment conservation and the preservation of the balance between man and his/her environment, the preservation of which constitutes a must for the existence of life.

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Cartographic developments and challenges for dissemination of geospatial data

Submitted by the International Cartographic Association**

The ICA Mission (www.icaci.org)

The mission of the International Cartographic Association is to promote the discipline and profession of cartography in an international context.

ICA is the world authoritative body for cartography, the discipline dealing with the conception, production, dissemination and study of maps. A map is a symbolised image of geographical reality, representing selected features or characteristics, resulting from the creative effort of its author's execution of choices, and is designed for use when spatial relationships are of primary relevance.

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The International Cartographic Association exsits:

- to contribute to the understanding and solution of world-wide problems through the use of cartography in decision-making processes;
- to foster the international dissemination of environmental, economic, social and spatial information through mapping;
- to provide a global forum for discussion of the role and status of cartography;
- to facilitate the transfer of new cartographic technology and knowledge between nations, especially to the developing nations;
- to carry out or to promote multi-national cartographic research in order to solve scientific and applied problems;
- to enhance cartographic education in the broadest sense through publications, seminars and conferences;
- to promote the use of professional and technical standards in cartography.

The Association works with national and international governmental and commercial bodies and with other international scientific societies to achieve these aims.

In the context of dissemination of geospatial data it must be stressed that cartography not only deal with compilation and presentation but also the use of the information.

A Cartographic Approach to Spatial Data Infrastructures

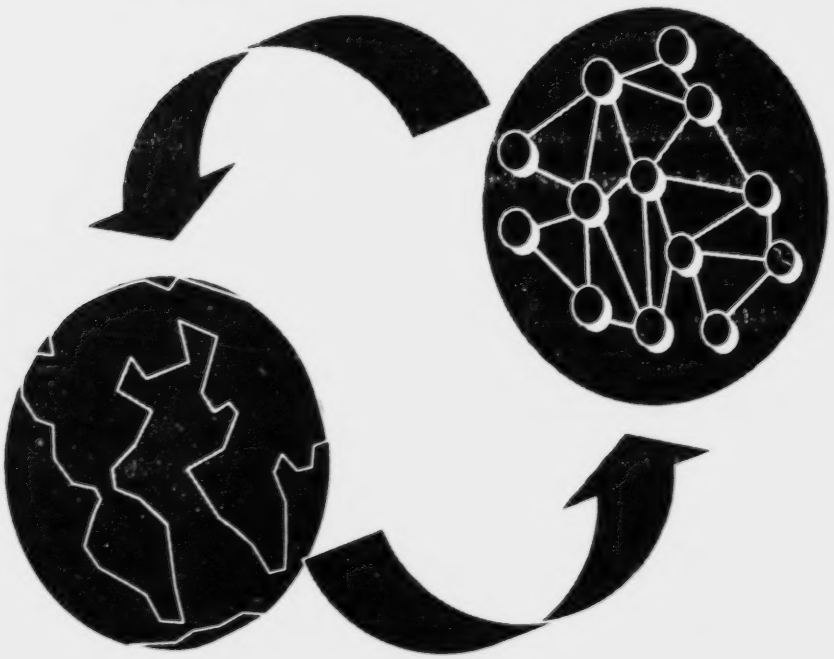
It is often stated that 80% of all data can be tied to a location. In cartography we deal with location of real world objects and of activities in the natural and cultural environment. By considering the whole life cycle of each object together with its usage and user(s) it is easy to realise that the ability to handle location has a great potential, which includes many possibilities to increase the efficiency of the cartographic displays in decision support systems.

General

At the general level we see that geospatial data will be available and used in many kinds of applications. Almost all countries are in the process of establishing a National Spatial Data

Infrastructure as exemplified in other papers to this conference. Furthermore, the infrastructure for telecommunication will facilitate the accessibility not only to office use but also for use in mobile units. The vision by ESRI, the Environmental Systems Research Institute, visualised in the graph below will be a reality in many countries within a few years.

Vision by ESRI



Geographic Knowledge Will Be Available To Anyone, Anywhere, Anytime!

The graph shows the vision by ESRI, Redlands, California, USA (http://www.esri.com).

There is, however, also a great need of standardisation and development of methods to describe the spatial objects we are dealing with. The technical committee number 211 of the International Standardisation Organisation (ISO/TC211) is currently developing standards for geospatial data. Since a general description of all kinds of geographical features is complicated in a talking language it is even more complicated to achieve a description to be understood by a computer. The full standard will comprise a set of sub-standards and in addition be based on other IT standards. According to the latest time-table the first standards will be released during 2001. The importance of the ability to deal with data from different

sources with relevance to sustainable development is exemplified as follows (Haagenrud et.al., 2000):

Global

Since the Rio Summit in 1992 when the Agenda 21 was formulated environmental concerns at the global level have been in focus. The today debated but in general acknowledged Green House effect and spectacular weather phenomena like El Nino, severe flooding or draught events in parts of the world have in later years underlined the importance of these issues. GIS based simulation models visualised by animated maps are since long in operation and part of the common set of tools in studies of the effects of such phenomena can be of great importance in exploring the possible consequences of climatic change.

Another area where GIS modelling and simulation plays an increased role is mapping and modelling of air pollution (Haagenrud, 1997). UN Global Environment Monitoring System (GEMS/AIR 1973-1992) is an urban air pollution monitoring and assessment programme, which evolved from a World Health Organisation (WHO) urban air quality monitoring pilot project that started in 1973. Since 1975, WHO and the United Nations Environment Programme (UNEP) have jointly operated the programme as a component of the United Nations systemwide Global Environment Monitoring System (GEMS). GEMS is a component of the UN Earthwatch system.

GIS modelling and simulation is also of paramount importance in the studies and mapping of the long-range transboundary air pollutants (Kucera et.al., 1998).

This subject has been the focus of a UN ECE Convention since a number of years and international research programmes support economic evaluation of air pollution abatement and the resulting effects on corrosion damage to buildings and cultural heritage.

Regional

The building and construction sector is the main consumer of materials, energy and other resources. In the industrialised world building is estimated to answer to some 40% of societies total energy consumption and construction itself produces approximately 40% of all the man-

made waste. These facts are today receiving high attention. Techniques and methodologies for reuse and recycling of materials are being developed and there exists good examples, regionally and locally, of growing markets for reuse of materials and products.

Cartographic modelling of the distribution and flow of materials in the built environment is, in this perspective, a good example of a priority area. Seeing the materials in the existing building stock as a presumptive resource for new and re- construction is well in line with the sustainable development approach. A number of studies have been performed, on both smaller and lager scales and on various aspects of spatial distribution of building materials, that can be used as basis for concerted and directed R&D to develop and refine appropriate cartographic modelling techniques.

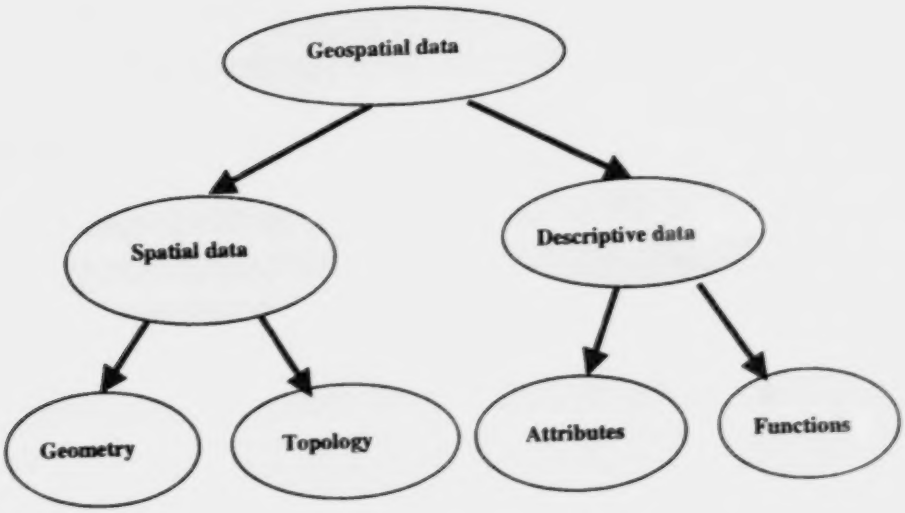
Local

Characterising and controlling the micro-environmental exposure conditions are one of the main challenges for the surveillance and maintenance of our environment To day multi-sampling instruments with automatic data capturing tools are available for temperature, wetness and UV, and passive samplers for gases and particles also exist. Available dispersion models for roads and street canyons can also model the air quality and exposure of buildings. Traffic planners are often in need of practical tools for studying the effect of abatement strategies on air quality in streets where people are exposed. Here again cartography offers powerful tools to visualise the invisible.

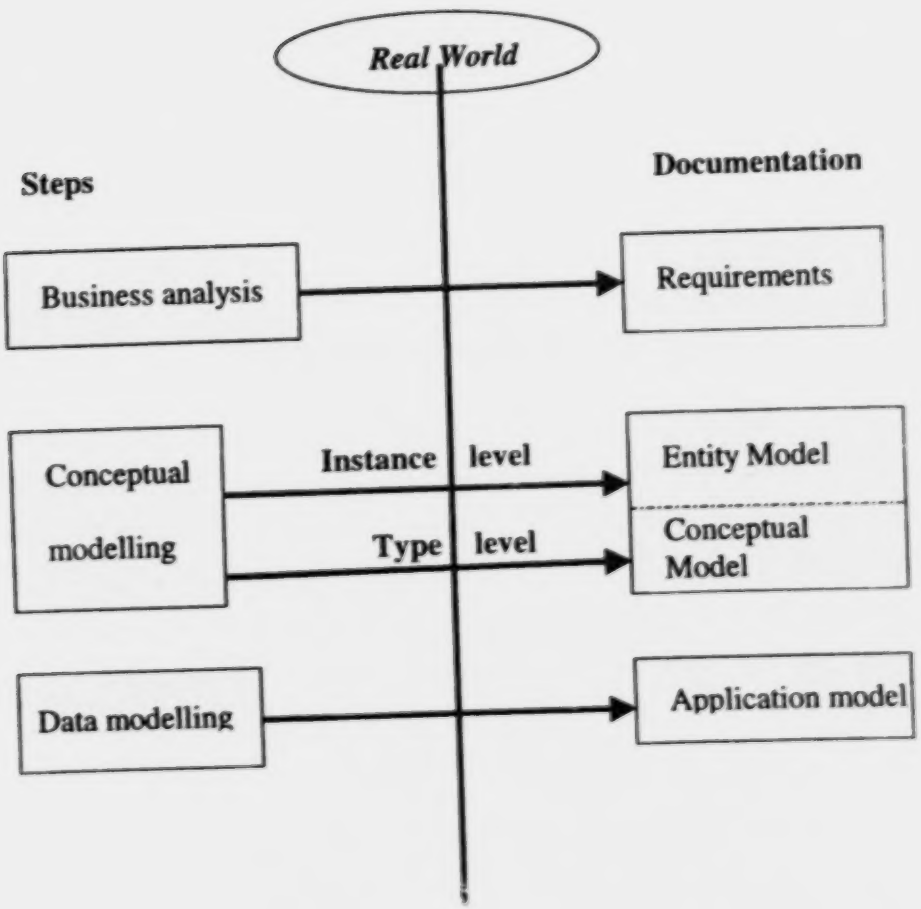
Creating the Geospatial Database

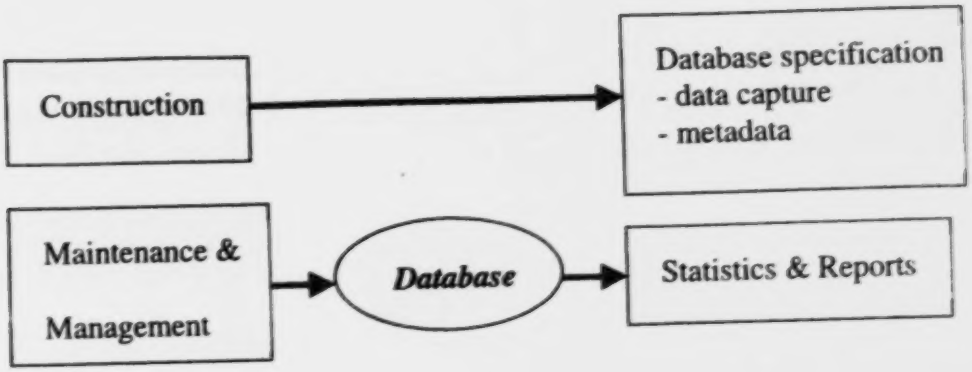
The terminology

Geographic data include *spatial data* and *descriptive data*. *Spatial data* deal with location and shape (geometry) and relationships (topology) among geographical features. *Descriptive data* or *attribute data* deal with other characteristics of the features than geometry and topology. *Geographic Information* concerns phenomena associated with a location relative to the Earth or knowledge obtained as a result of processing geographic data. Geographic can be replaced by *geospatial* giving the alternatives *geospatial data* and *geospatial information*. Geographers prefer geographic and land surveyors may prefer geospatial.



The figure shows the classification of geospatial data.



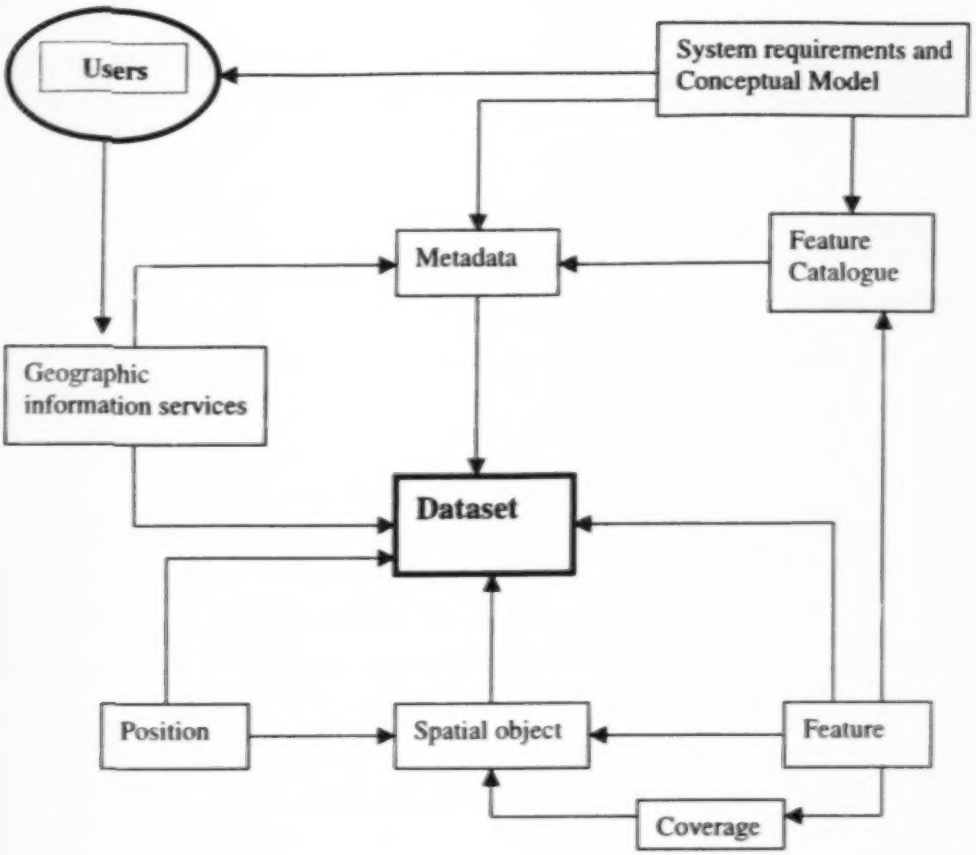


The graph shows the working process for data base construction.

This working process has been developed over a rather long time and origins from Donna Peuguet (1984). Methods for systems development have also been developed during several decades. The innovations in object orientation in combination with methods proven as successful have resulted in the Unified Modelling Language (UML), which now can be considered as a standard for modelling (Booch, Rumbaugh and Jacobson, 1999). The standardisation work conducted by ISO/TC 211 and the Open GIS Consortium (OGC) is now in a final phase for releasing the first standards for geospatial information.

Framework for standardisation of topographic information

This section gives an overview of an approach to standardisation of topographic information in a rather general form that can be adopted to similar applications. It is based on the ISO standardisation of geographic information (ISO 19100, Reference model). It is envisaged that this approach will be compliant with the forthcoming ISO standard. The following diagram shows a possible implementation of the different parts and their relationships:



The contents of this diagram may be described as follows:

The *dataset* contains instances of the features (spatial objects) described in the feature catalogue, including attributes, relationships, and functions (defined mathematical operations for computing information about feature classes) in accordance with object oriented techniques.

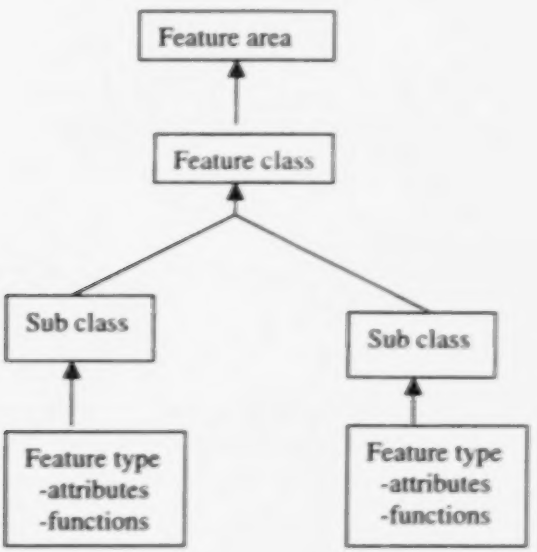
A coverage is a complex data structure that associate values of attributes to individual positions within a defined space or geographic area. A rasterised image and a an elevation model in grid form are examples of coverages.

The *metadata* allows users to search for, evaluate, compare and order geographic data. It describes the contents in the dataset in such way that it is possible for a client to evaluate the

fitness for use (quality) of the data. The structure of the *metadata dataset* is standardised by ISO 19100-15.

Geographic information services, comprise a set of software with purpose to correctly perform retrieval operations as well as manipulation operations such as transformation and interpolation.

The *feature catalogue* shall present the abstraction of reality represented in one or more sets of geographic data as a defined classification of phenomena. The feature catalogue gives a collective classification and description of the feature types. In order to get a good structure of the catalogue we organise the feature types into feature classes and feature areas in the following way:



With feature area we understand the part of the universe as it is described in the application schema, which is sub-divided into feature classes. Examples are communication, elevation and waters. A feature class can be divided into subclasses.

The Topographic Base Map Feature Catalogue

Feature Classes and Feature Types

The feature classes and feature types for a digital topographic base map might be:

Administrative boundaries

Sub classes are administrative boundaries and natural reserves. Administrative boundary feature types are national boundaries, provincial boundaries, district boundaries, urban district boundaries, local government areas and perhaps also tribal land. Natural reserves feature types are forest boundaries, national parks, game management areas.

Infrastructure

Sub classes are roads, railways, power lines, pipe lines and telecom. The feature types are segments, nodes (crossings), road signs etc.

Settlements

Sub classes are urban settlements and rural settlements.

Land use

Sub classes are cultivation and plantation, forest and natural vegetation.

Hydrology

Sub classes are lakes, rivers, dams, wetlands and springs.

Relief

Sub classes are contour lines, spot heights and geodetic points.

Geographical names

Sub classes in accordance with the above feature classes.

Conclusions

Geospatial data will play an important role in many different applications in the future. Many users will have problems to integrate data from different sources. Data providers, like National Mapping Organisations, have to adopt standards and well proven techniques to build and provide data to the users. This paper has shown that there is a machinery available.

References

Booch G., Rumbaugh J. and Jacobson I. (1999): *The Unified Modelling Language User Guide*. Reading, Massachusetts, Addison-Wesley Longman.

Haagenrud, S.E., Rystedt, B., and Sjöström, C. (2000): *GIS in the Built Environment* International Council for Research and Innovation in Building and Construction (CIB). Report No. 256. Published by University of Gävle, SE-801 76 Gävle

Haagenrud, S. E. (1997), *Environmental Characterisation including Equipment for Monitoring*. CIB W80/RILEM 140-PSL Sub-Group 2 Report, Norwegian Institute for Air Research, NILU: OR 27/97.

Kucera, V., Tidblad, J., Henriksen, J.H., Bartonova, A. and Mikhailov, A.A. (1998) *Statistical analysis of 8-year materials exposure and acceptable deterioration and pollution levels. Convention on long-range transboundary air pollution*. Prepared by the main research centre, Swedish Corrosion Institute, Stockholm. (UN ECE ICP on effects on materials including historic and cultural monuments, Report No. 30).

Peuquet, Donna J. (1984): *A Conceptual Framework and Comparison of Spatial Data Models*. Cartographica, Vol. 21, No. 4, pp. 66-113.

Web pages

CIB: http://www.cibworld.nl

ESRI: http://www.esri.com

ICA: http://www.icaci.org

ISO: http://www.statkart.no/isotc211

OGC: http://www.opengis.org

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Geospatial data dissemination: reality, obstacles and possibilities

Submitted by the International Cartographic Association**

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I. General Issues

What do we understand as dissemination of geospatial data? Is it enough to produce and distribute high-tech information products?

The following are critical issues that should be addressed as our starting point.

The interaction process between data producers and society

Often the main producers of geospatial data are "experts and highly specialized personnel" in governmental organizations and scientific institutions. Scientific communities sometimes have a tendency to view society with a degree of "arrogance." From our point of view, the process of information dissemination to society should be undertaken as a respectful interaction between data producers and data receivers.

The mere design and implementation of highly sophisticated products and services of geospatial data does not suffice in a comprehensive dissemination project. Through proper interaction processes, the construction of "knowledge bridges" between users and producers of geospatial data should be emphasized. In brief, the impact of geospatial data products and services on society should be assured via well-developed methodological approaches that give proper attention to the receiver.

The role of geospatial information in society

Deep thought should be given in dissemination processes to the role that geospatial data will play for individuals, organizations, institutions, the community or the nation. Too often, the scientists involved in data acquisition and processing are too caught up in the technical and technological tasks involved.

Due to its graphic nature, geospatial data is an effective means for communication. As such, geospatial data can be highly effective in public policy interaction processes. Geospatial data is unquestionably an important tool for military activities, planning, education, business management, and so on. This transversal characteristic points to the need to give thought to ethical and practical issues regarding the role and impact that the services and products of geospatial data will have on society.

The binomial relationship between information and knowledge

Rather than undertaking a philosophical discussion on the meaning of knowledge and its interrelation with information, we simply wish to point out that whenever data and information are disseminated, it is implicitly assumed that the user will incorporate it into his or her own knowledge framework/base.

The same data and information could lead to different interpretations by distinct individuals and societies. In order to be more effective, dissemination programs should take into account the knowledge framework of the receivers.

II. Constraining Forces

There are constraining forces in the dissemination process that are strongly related to cultural and organizational issues. Following, some of these forces are identified.

Attitudes. - The personal, organizational, and cultural attitudes involved in information management could be decisive when defining strategies and policies of data dissemination. Countries with well-established laws regarding the "right to information" will differ strongly from others where information is perceived as a privileged asset for those in power (a fiefdom). For example, while in the U.S. geospatial information is considered mostly a public asset, in most Latin American countries its dissemination is highly restricted.

Technological infrastructure. - Regional and social differences that determine the availability of information and communication technologies are very clear-cut. While the assimilation of new communication means such as the Internet is well advanced in the U.S., Canada, and some Western European countries, in Latin America it is still a comparatively scarce resource.

Scientific knowledge. - The degree of development of science in different regions and social groups also has an important impact on information dissemination. Systems Theory is without a doubt part of the crux of information management. A society where (private or public) organizations lack a culture of systematic data acquisition, processing, and updating could hardly have a well-established system of data dissemination.

Copyright. - Copyright laws and practices are well established in some countries, unfortunately in some others they are not. This issue poses serious problems for data producers since the dissemination process without copyright safeguards has an obvious impact on costs and marketing procedures.

III. Driving Forces

In a similar manner, there are driving forces affecting dissemination processes, such as:

Globalization. - Information technology and data dissemination are two of the main driving forces of globalization. Worldwide news is being publicized through the Internet; the market as a whole is taking advantage of telecommunication tools, individuals obtain information for their personal interest from newspapers, magazines, and the WEB, among others, and there are already hundreds of maps available on the Internet.

Although the dissemination of science occurs at varying velocities in different societies, historical trends indicate that electricity, telephones, and newspapers are assets that have been incorporated into a wide number of social groups around the world. We could therefore assume that other technological developments such as the Internet, computers, and cellular phones will someday become common goods for an ample sector of the population.

Scientific development. - Both knowledge and technology have substantially advanced in the last century. We could assume that the knowledge base will increase, that some of the information and communication technologies will be perfected, and that new technologies will surprise us.

The right to information. - More societies are becoming aware of citizens' right to information. Through different mechanisms of political pressure, citizens (as a whole) are obtaining more access to information.

IV. A Regional Scenario for Latin America

Culture (common origins and languages) strongly unifies Latin America as a region. Both the constraining and the driving forces are influencing the success or failure of geospatial dissemination processes. As a means of focussing on the issues that could affect the process in a positive manner, two scenarios for the year 2005 were explored. In the first one, it is assumed that current trends remain. In the second one, it is assumed that "adequate" public policies are implemented in order to promote a comprehensive process of geospatial data dissemination.

Current trends scenario

The setting. - Latin American society, including Mexico, Central and South America (except Belize and the Guyanas). Although Latin America is highly complex and heterogeneous, there are some similarities in the problems that geospatial data dissemination poses.

The actors. - Geospatial data producers are divided between civil government and the military. For example, in Mexico, Colombia, Guatemala, and Brazil, producers are governmental organizations within civil ministries; while in Peru, Argentina, and Chile, mapping organizations belong to the military.

As in many other countries, users include government, private and social organizations, researchers, students, and citizens.

The international community plays an important role both as producer and user. Satellite images, for example, are obtained from the U.S., Canada, or Europe. International

organizations such as the UN, the OECD, World Bank, and IDB are often both important users and producers of geospatial data for the region.

The play

First Act. - Latin America year 2000. The above-mentioned constraining and driving forces are performing. Government and international organizations continue to dominate the dissemination process of geospatial data. There is a lack of "information culture" and dissemination is very partial; people and organizations do not even share basic data such as topographic maps.

Data producers are highly inefficient due to a duplication of efforts in data acquisition and processing. Overall, the lack of copyright practices is having a strong impact on the development and marketing of services and products.

A few international projects such as the global mapping initiative, clearinghouse-building efforts, and other specific projects like the Continental Water Atlas are having some influence on the dissemination process.

On the other hand, the Internet is available and has an impact on privileged organizations and groups, which are taking advantage of the new IT. The more educated portion of society has access to the geospatial data disseminated by the international community.

Computers and the Internet are penetrating the business world, government, and society as a whole. Latin American society acknowledges the importance of computers and the Internet; however, they are still resources available only to privileged groups.

Politicians often speak of the relevance of education, information, and science. However, in Latin America, investment in any of these activities is far lower than needed, and even more so when compared, in relative terms, to the U.S., Canada, and some European countries.

The gap in scientific development between Latin America and the U.S. in terms of both knowledge and technologies is maintained. For example, in Mexico the impact of the Internet is about ten years behind the U.S. market. Although people have access to technology, a very small portion of information is actually used by Mexicans.

Final Act. - Latin America (year 2005). The Constraining and Driving Forces continue to have an impact. The Constraining Forces remain essentially unchanged; the Driving Forces are stronger due to developments in the industrialized regions.

New geographic information technologies are developed and the availability of computers and telecommunications has expanded around the world. However, there is still a significant gap between the assimilation of technology in the industrialized region and Latin America as a whole. Similarly, science has not been fully acknowledged by governments and only an elite group has access to new developments.

Users will have greater access to geospatial data produced in the industrialized region through the Internet. However, the "critical mass" of educated people needed to take full advantage of this resource is not in place. The design, production, and dissemination of geospatial information services and products continue to be mainly "producer driven."

YEAR 2005

Latin America is a "follower" regarding both knowledge and technology in Geographic Information Sciences and Management. Regional personnel are used for repetitive tasks.

Target scenario

The setting. - In the year 2001, the Constraining and Driving Forces continue to have an impact although several specific public policies regarding Geographic Information Management are implemented in the years 2002-2005 by the governments in conjunction with international organizations. The overall scenario for the region regarding geospatial dissemination processes develops some strategic changes.

Final Act. – In the year 2005, the governments of the region are more aware of the importance of copyright issues regarding geospatial data. Laws are established and copyright enforcement achieves significant advances.

Universities and research institutions in the region acknowledge the importance of education in Geographic Information Sciences (GIS); there are several graduate programs

in place as well as technical training programs. The first substantial results are programmed for the year 2010.

Beginning in the year 2002, a **crusade for capacity building** is promoted and sustained by international organizations including NGOs and regional organizations. A participatory approach is privileged with the incorporation of educated people from Latin America. Universities and government are working together in the region providing Latin American teachers for the "capacity-building crusade." As a result, in the year 2005, we find in place the "critical mass", of educated and trained personnel in Geographic Information Management, required to meet the demands of society.

Governments, international organizations, universities, and private and social sectors adopt an "information-sharing" culture. Millions of dollars are saved in the region by sharing "public geospatial data." The use of geospatial data is an input for strong analytical GIS solutions that adequately respond to the needs of society.

The design, production, and dissemination of geospatial information services and products are finally in a "demand driven" mode.

There is stronger global scientific participation in the region, contributing with solutions and technological innovations that are responding to regional interests and specific problems posed by society.

V. Final Comments

Geospatial data dissemination is an issue that has deep and wide-ranging implications on the regional information management scene. Although there are obvious differences in the Latin American region, similarities in key issues could allow for the design and implementation of similar public policies that would transform the role played by the region in Geographic Information Sciences and Management.

From our point of view, public policies should focus in the short and medium term on four strategic courses of action:

- Creating a new and strong tendency that incorporates universities, research institutes, interested groups, communities, organizations, and individuals into an open-minded, balanced framework capable of countering an ingrained older tendency.
- Designing dissemination processes which necessarily include efforts towards assuring a "critical mass" of educated people with the knowledge required to take full advantage of the geospatial information that producers are making available.
- Taking advantage of cooperative driving forces from outside and within that will contribute to capacity building, efficiency, information technology infrastructure, and leadership building in the region.
- Focusing efforts on strengthening the "information-sharing culture" always in conjunction with a growing "right to information" culture while taking into account the demands posed by society, all within well-established copyright laws and safeguards.

BY THE YEAR 2010

Latin America is a leader and not a follower in Geographic Information Sciences and Management.

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The role of the Permanent Committee on Spatial Data Infrastructure for the Americas

Submitted by the Secretariat**

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The Role of the Permanent Committee on Spatial Data Infrastructure for the Americas –PC IDEA

A background paper for the 7th United Nations Conference for the Americas New York, 22-26 January 2001

Prepared by Santiago Borrero

Summary

In 1997, during the Sixth United Nations Regional Cartographic Conference for the Americas, the delegates noting and recognizing the rapid global emergence of national and regional spatial data infrastructures and its contribution to maximize the benefits of geographic information for sustainable development, recommended the establishment of a Permanent Committee for SDI/GIS Infrastructure in the Americas, reporting for consideration to the following meetings of the UNRCC- Americas.

To satisfy this requirement, this paper after presenting a brief introduction to the subject, focuses mainly on (i) the Latin American scenario, by providing essential regional background; (ii) describing the current situation of the early 2000, when, as recommend, the Permanent Committee on SDI for the Americas PC-IDEA was created; (iii) debating key aspects pertaining the need for SDI infrastructure development at the local, national, regional and global levels, and (iv) noting the situation of the Global Map initiative from the Americas perspective.

The paper concludes by presenting policy recommendations to foster development of SDI in the Americas, in the context of the role of the UN regional cartographic conferences, and a basic bibliography on the subject.

The Role of the Permanent Committee on Spatial Data Infrastructure for the Americas –PC IDEA

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INTRODUCTION

It can be stated that Latin America, with 17 SDI initiatives identified at the national level, is now looking seriously at the importance of having a regional spatial data infrastructure. Still as for data production, policies, seamless data and standards there is no regional integration at all, yet there are some exemptions; government budgets applied to mapping activities are, in the average, marginal and there is evident need for training and specialized education on geoinfomatics. International technical cooperation has a crucial role to play in the development and sustainability of more open, advanced and integrated mapping systems in the Region.

Of course, at its own pace, Latin-American is responding to this challenge. At the Sixth UNRCC for the Americas (NY, June 1997), regarding geographic policy formulation and data production in Latin America, deliberations focused on whether the Conference is "for" the Americas or only taking place "in" the Region. Partly, as a direct result of this deliberation, it was convened to create an inter-sessional working group of experts whose task was to "re- engineer" the UN regional conferences, propose a new mission statement and agenda, incorporating issues relevant to each region and giving priority to "development of national, regional and global strategies for managing geospatial data".

The Permanent Committee was supposed to be created one year after the UNRCC in New York. However, its promotion needed additional effort. Many understood the new drivers behind the GIS/SDI orientation of the proposed committee, others were comfortable with the by then still prevailing "conventional" cartographic approach.

Experts can say that is not surprising at all. South America, a region of significant contrasts, is still mostly covered by analog maps elaborated at small scales averaging 1:500.000, with significant levels of obsolescence. In a space twice as large as Europe there are 10 national mapping organizations while in the Old Continent there are over 40. Considering that "an attitude" is today fundamental for an efficient participation in the elaboration and management of global data, one can see that the road ahead is not yet paved for initiatives like Global Spatial Data Infrastructure -GSDI, Global Disasters Information Network -GDIN or the Global Map. This is also a problem of budget and one of adaptation to the ICT revolution.

This paper faces this reality, however, with an optimistic approach to this challenge. The use of spatial information all over is growing rapidly and, though there is a limited capacity to produce and consume digital information, the region is already immersed in the technology change.

I. SPATIAL DATA INFRASTRUCTURES IN LATIN AMERICA: AN ESSENTIAL BACKGROUND

It was not the most comfortable or ideal situation, but most of the national mapping agencies were very used to analog cartographic production by the time the digital world came into the region announcing the upbringing of the Information Society. How this process is understood and managed is having an impact on the way regional spatial data infrastructures are developing. Plenty of work needs to be done, from the bottom-up and from the top-down. Professionals working in the Region still have lots

of questions and problems. It is in this context, that they will need to understand the benefits of SDI initiatives and why, concerning economic growth and sustainable development, it is essential for many of them to become internationally open and more globally oriented.

The following are key elements to understand the scenario facing the development of regional spatial data initiatives:

Contribution of the Panamerican Institute for Geography and History (PAIGH) contribution to standardization in the Americas

PAIGH, created in 1928 as a correspondent member of the Organization of American States (OAS), is located in Mexico City, the Institute provides technical assistance, training through research centers, distributes publications and supports technical meetings about cartography, geography, history and geophysics.

In spite of PAIGH financial difficulties, some distance with vanguard technologies and modern management tools, its dedication and commitment to the region as a whole, strongly influences effective execution of any strategy oriented to the formation of spatial data infrastructures in Latin America, involving its members.

Regional standards for data production and distribution are not necessary a part of the cartographic tradition in the Americas. The following are two examples, briefly presented:

1. PAIGH elaborates the "Status of Mapping in the Americas'" index maps describing the availability of geospatial data trough the Americas. PAIGH created in 1961 a Working Group intended to produce cartographic standards for the region. In 1968, the group approved the " Standard for Analog Cartography in Latin America". In

spite of the effort, very soon almost every mapping agency introduced significant modifications to the standard, "adjusting" it to local conditions.

2. The Interamerican Geodetic Survey (IAGS) during the 1960's introduced a program to establish for Latin America, a reference system to which all gravity anomaly surveys in the region could be referred. In 1972 PAIGH and the Canadian government joint the project and produced in 1977 an absolute datum as defined by the International Gravity Standardization Net1971. Consequently, it was adopted as gravity reference standard for Latin America. Since then, RELANG survived under the care of Canada. It was transferred to a Latin American nation in 1982, where it experienced severe operational difficulties and in 1987 returned to Canada. However, in 1997, Canada withdrew from PAIGH and Colombia agreed to take over the responsibility for the operation and maintenance of the RELANG data base, which interconnects some 1500 stations in 22 countries.

The work of DIGSA concerning standards and data infrastructures

Created in 1978, DIGSA is the summit reunion of national mapping institutions in South America, Spain and Portugal. It is a meeting of policy-makers. DIGSA eases exchange of information between members and stimulates formation of common policy in specific areas for mutual benefit. Although DIGSA concedes priority to aspects like licensing, copyright and training policies, also digital data production, maintenance and quality are issues of its special attention.

Consequently, this Directorate also has potential to induce relevant policy regarding regional and global information infrastructures. The following are two examples fo initiatives supported by DIGSA:

1. The South-American System of Geocentric Reference –SIRGAS, will be a unique geodetic reference system for South America, used also to standardize aeronautical

data. Since there are various local systems of reference, SIRGAS will eliminate existing anomalies concerning geographic position and cartographic representation among nations in the region, by providing common ground to the system of geodetic coordinates.

The methodology applied for SIRGAS will also influence regional and global data infrastructure initiatives. SIRGAS has been a teamwork project and, given circumstances, is working well. The project directly relates the use of GPS technology and spatial data, with important levels of institutional involvement and compromise.

2. The Physical Map of South-America. In 1992 DIGSA agreed to produce a digital and analog map of South America 1:5'000.000, as a first way to elaborate seamless regional data, looking also to enrich several thematic applications. In 1996 in Spain, the Map was finally delivered.

Standards, infrastructures and thematic data

As it happens in most regions, in the Americas thematic data and mapping production is commonly carried out in different places, both public and private, resulting in enormous diversification, lacking standards, with significant quality problems and incomplete documentation of data.

Of course, as happens with basic cartography, there is evident need for standards, metadata, and infrastructures for thematic applications in Latin America. These are two examples:

1. There are no standards for land classification systems. Soil surveys follow the Soils Survey Manual (1993), soil taxonomy (1998) and soil survey laboratory methods

manual, as introduced by the USDA. However, important exemption applies in the region: for instance, Mexico uses the FAO soil classification system and Brazil has its own national soil classification system. Regarding small scale information, FAO's Global and National Soil and Terrain Digital Database (SOTER) is widely used in Latin-America. Concerning soil survey classifications, most nations in the area follow the Land Capability Classification, develop in the United States, but adapted to country conditions. Colombia and Venezuela, for instance, have incorporated their own Agroecological Land Classification System and Biophysical Land Zoning Method.

2. Pertaining cadastral standard the current situation is not this advanced. Most nations do not have cadastre information structured or referenced. There are, however, important exemptions. Colombia, for example, follows the cadastre standard developed by the US Federal Geographic Data Committee, since data content is quite similar. Also, this issue is just starting to be studied within the context of subregional markets, as there is some demand for seamless data related to bordering areas and titling processes.

The Inter-American Geospatial Data Network initiative (IGDN)

IGDN was the first regional spatial data infrastructure effort for the Americas. Introduced in 1994, IGDN develops under the responsibility of the EROS data center in partnership with the USAID. As presented at the UNRCC in 1997, IGDN focuses on application of Internet capabilities in the Western Hemisphere for electronic access to information describing the existence and availability of geospatial data. IGDN, also aims to provide technology to countries in the elaboration of national and Latin-American electronic atlases and clearinghouse systems.

II. FORMATION OF THE PERMANENT COMMITTEE ON SDI FOR THE AMERICAS –CPIDEA: A report.

In 1997, during the Sixth UN Cartographic Conference for the Americas deliberations, when considering the main issues debated, the outcome was obvious:

need for spatial data infrastructures at the national, regional and global levels, global mapping requirements, diversity of new technology available and regional project needs, arising from country reports and from delegate interventions, such as the Inter-American Biodiversity Information Network -IABIN, the Inter-American Geospatial Data Network –IGDN and SIRGAS for the establishment of a unique geodetic reference system for South America.

Resolution 3 of the 6th UNRCC for the Americas recommended all member States in the Region to establish a Permanent Committee on GIS/SDI "within one year". In February 1998, taking advantage of the Working group delegates an experts meeting held in Aguascalientes, Mexico to define the mission and focus of the 7th UNRCC for the Americas, the delegates representing member states from the region established the Committee, in an *ad-hoc* manner, with Colombia elected as *pro-tempore* chair until full formalization of the committee was achieved, within the following year.

- A three years process

However, this was not an easy goal to obtain, there were several reaons: (a) The idea of spatial data infrastructures for Latin America was difficult to digest at a time when many national mapping and surveying organizations were in the level of "initial acceptances" for technology innovation, making "changes in old organizational structures"; (b) Agenda 21 was introducing the need for information related to sustainable development; (c) Specialists were in the process of redefining their own data in the digital format from a local perspective; (d) Ideas were not yet clear and nationalistic attitudes behind previous failures concerning regional standards for mapping and geodesy; (e) Poorly documented, referenced and structured data, and lack of infrastructure affecting the possibility to access, consume and disseminate digital spatial information; (f) isolation, expressed in low levels of participation at the

global level and (g) of course, the fact that most organizations were (still?) digitising old data.

Consequently, promoters of the committee started by convincing Latin-American state members about the need for harmonic spatial data infrastructure at the local, national, regional and global levels and its contribution to economic, social and environmental sustainable development. The Region evolved since then trying to overcome the above listed elements, confronted at the starting point.

-A new situation

There are several reasons behind this change: (a) The Panamerican Institute for Geography and History –PAIGH, as well as the Directorate of Geographic organizations for South America –DIGSA are involved in the promotion of enabling information technologies and spatial data infrastructures; (b) There is a wave of optimism derived from recent experiences, such as SIRGAS and the IGDN/PAIGH Electronic Atlas; (c) Numerous ongoing national SDI initiatives; (d) Growing awareness about the direct relation between information, economic growth and development; (e) Increased appetite for spatial data; (f) Need to improve spatial data availability to support better project formulation and decision-making; and, (g) The impact of regional and global initiatives like the Global Spatial Data Infrastructure and Global Map.

- How different is Latin America from other regions in the world? Results from a survey for PCIDEA

In 2000 a survey conducted by Glenn Hyman and Kate Lane (CIAT), along the lines of the one elaborated by Prof. Harlan Onsrud for FGDC. The results, among other aspects, picture the following situation in Latin America:

- GIS/SDI issues are still leaded by National Mapping Agencies, but are now challenged by other type of geographic information providers.
- There is absence of policy concerning development of national spatial data infrastructures.
- There are 17 SDI initiatives in the Region, under responsibility, in the average, of 5 national organizations.
- Industry and other type of technology providers are not yet involved in the development of these initiatives.
- Basic layers that are most frequently considered as fundamental data are: Topographic mapping; roads; land cover and land use; administrative borders; hidrography.
- There is a tendency towards cost recovery, as main factor for pricing data.
- The major constraints for consolidation of these NSDI initiatives are legal issues and funding, lack of national standards for geodata, pricing and data access.

By facing this new situation, the Americas decided to formally establish its own regional committee on GIS/SDI.

- PC-IDEA, finally, a reality

The already mentioned Resolution 3, out of the 6th UNRCC for the Americas, in addition to invite the region to form the committee, also recommended to submit reports to the UNRCC's. Consequently, the purpose of this section is to inform about the establishment of the "Permanent Committee on SDI for the Americas –PC-IDEA, as the main result out of the Seminar on Spatial Data Infrastructures and the Workshop on Metadata, organized this past February 28 to 1 March 2000, by the Colombian Spatial Data Infrastructure –ICDE and the Geographic Institute of Colombia "Agustin Codazzi" in Bogota.

Relevant support was also provided by the World Bank Infodev Program, the Center for Inter American Agriculture Technologies -CIAT, the US Federal Geographic Data Comittee and the Pan American Institute for Geography and History -PAIGH. Provisional statutes were adopted and three working groups were initially organized: (a) Legal and economic affairs (Chair: Venezuela); (b) Communications and awareness (Chair: Argentina); (c) Technical aspects (Chair: Uruguay). PC-IDEA was built on the experience observed in other regions, in particular, that of Asia-Pacific. On this regard the influence of the PCGIAP documents on statutes and rules of procedure, as well as those including the terms of reference for the working groups.

It is also important to mention that there were 208 delegates representing 21 nations from North, Central and South America as well as the Caribbean Islands, including special attendees such us the Ministers of Environment from Colombia and El Salvador, the Presidents of European Umbrella Organization for Geographic Information EUROGI and PAIGH, and delegates from the USGS and the UNECA.

The Committee is formalizing relations with all relevant international organizations. The Third PC-IDEA meeting will take place in Cartagena, Colombia, May 21-25, along with the GSDI 5 Conference and the 8th ISCGM Meeting (Global Map).

- The vision of PC-IDEA: "the end of information isolation in the Americas"

The role of the Committee is essential for the development of spatial data information capabilities, at all levels, in the Americas. A recent report on worldwide spatial information trends, elaborated by IDC, demonstrated that those focusing on the use of spatial technology are growing at rates two to three times faster than companies concentrated on traditional geographic information system technology.

It is in this context that the main drivers in the Region are appealing to the work of the Committee. In the Americas we are now (a) Increasing production of spatial data

impacting R+D and sustainable development; (b) Migrating from local data to National Spatial Data Infrastructures, leading to regional spatial data sets; (c) Increasing knowledge capabilities for all members in the American hemisphere community, by incrementing access to data and information; (d) Contributing to the development of GSDI and Global Mapping capabilities; (e) Creating an Inter American forum for understanding national, regional and global GIS/SDI issues and (f) Placing geoinformation as one strategic sector for development.

III. DEBATING THE NEED FOR SDI

In every country, SDI reflects local conditions and identity. Geoinformation producers coincide on the need to develop a national spatial data infrastructure to efficiently build, share and distribute geographic data nationwide. This is the essence behind the concept of national spatial data infrastructures.

In the first stage, it is expected, results should include a definition and realization of the following:

* Geographic metadata standard.
* Quality standard for geographic information.
* Standard related to Basic Geographic Object catalogue
* Standard on terminology
* Standard for land parcel classification
* National recognition of the geographic sector as strategic for development
* Increase geodata production and data-access
* Formal approval at highest level in government
* Tight links with other nations entities more advanced about NSDI
* Promotion within the local geographic community
* Incorporation of new IT to improve competitiveness
* Develop a national network of geographic information (clearinghouse system)

To accomplish SDI objectives is not an easy task. After all, how long it is taking to those nations well immersed into SDI to reach the point in which these basic goals are obtained and performing properly and, what the costs and the amount of resources involved? If answers were available, they should be in many ways surprising and indicative about SDI possibilities for the developing world and especially poorest nations.

As in most of Africa, a good part of Asia and Eastern Europe, in South America digital mapping data is the production priority. The Region is mostly covered by analog maps elaborated at small scales averaging 1:500.000, with significant levels of obsolescence. One difference observed between those NMOs financially better off, where new or well-maintained data is digitally formatted, and the limited ones, is the trend to convert old analog maps into digital data.

Most nations in the Region, in times of the Information Technology society, still has not formally adopted a national policy concerning use of geoinformation and the ways in which it will be used to promote wealth and development. Concepts, processes and other key SDI elements are not yet clear or well defined, particularly for developing countries needs. It is a fact that those non- SDI specialists at decision-making levels find still hard to understand the real meaning and the ideas involved.

The economic cycle of ups and downs in the developing world is more unexpected and reduced in time. Growing data needs and SDI challenges are happening in a period when investment budgets, as part of downsizing programs, are reduced drastically in too many nations.

Confronting data obsolescence and data production slopes:

In many nations the cartographic production line was modernised incorporating new technology. In the following years, nonetheless, production of basic data at national level has decreased because while other geodata providers have focused on the production of data at large scales for thematic applications creating a substantial amount of new, yet not always structured data, distracting government from the production of basic information with national coverage. Also, data maintenance is now a major difficulty, leading to an increasing situation of data obsolescence.

There is a kind of paradox in all this situation. Although there is more georeferenced information available, spatial data is not really playing, at least in developing nations, its due role in the decision-making process. Moreover, because digital data can be manipulated and presented in new and "fancy" ways, there are policy-making scenarios that nowadays are impressed by the form, rather than the quality of the data.

As a result, the lesson can be that data production and SDI building in emerging economies, to be successful, a minimum level of financial and institutional sustainability.

- Embracing the SDI option

The good part about SDI is that there is almost no choice for NMA's. No matter if there are large or few amounts of digital data elaborated, because of the nature of data, after a period its length depending on local conditions, users and producers will in developing nations understands that their data must be accessible, documented, structured and reliable or, otherwise, will be practically nonexistent. As for cartography this, is like a new kind of illiteracy. Without the Infrastructure, there is isolation. Analog map production was to the old national mapping authority, the reason for production monopoly, as digital data today is to the need for spatial data infrastructures.

In this market, of many data producers and demanding users, national mapping authorities have a new role, beyond data production, as coordinators and facilitators of this process. There is need to optimize the use of limited funds and to assure data quality and opportunity. The development of national SDI's is the way to benefit from this new and powerful situation. It will have a significant impact in national development.

This is why, when confronting this situation, a choice between data production or infrastructure development, the most successful are those nations that selected both. In addition to the basic institutional goal (to produce, analyse and make available data for various purposes), the current one gives the same priority to the design, promotion and setting up of SDI.

Developing nations must be aware about the need to expand their knowledge base. To achieve this goal emerging societies should look to all the information accumulated by the leading economies. This knowledge can be incorporated via international cooperation, technology licensing or foreign investment. Although it may be the decision of multilateral organisms to promote data sharing, in the end it is data owners right to decide "what data share". Nonetheless, about "how to share" data, this is also responsibility of the recipient, since the connecting dimension requires or will be optimized if spatial data infrastructure conditions are available.

Policymakers everywhere make relevant decisions without full information, yet in developing nations, due to chronic absence of key geodata, risks taken are even higher. At the highest level in government, not enough work is being done regarding the consequences of new space imaging technologies and applications, the renewed role of geoinformation and the way data sets can best be institutionally organized and used to efficiently address economic, social and environmental strategic issues.

- Multi/bilateral cooperation, International Geographic Organizations and the promotion of SDI

In many aspe..ts the SDI initiatives can move forward without support from the main multilateral organization. This could be the case of standards and metadata production. In others, for example "making SDI benefits accessible to all nations", as stated in resolution and declarations, more direct involvement and policy formulation seems essential. These organisations are and will be highly influential in developing nations and the need for a more clear endorsement pertaining SDI is essential.

As for the UN system, the situation was studied during the 1997 UNRCC for The Americas, concluding later with a proposal for the creation of a UN Permanent Geographic Information Commission and the need to re-engineer the Regional Cartographic Conferences, elaborated by the 1998 Special Working Group reunited in Mexico. The main issue still remains and that is how the UN will move from actual recognition of SDI relevance to a more practical level of involvement in spatial data infrastructure promotion. For instance, United Nations support appears vital to facilitate regional participation and access of developing countries to already available key spatial data.

Also, The World Development Report of 1998/99 called for the Worls Bank attention on the ICT impact, in the context of the following policy: (1) developing nations must include policies to narrow the knowledge gap, (2) all parties must work together to strengthen the institutions needed to address information problems and (3) knowledge is at the core of any development effort. The Report states that "developing country governments, bilateral donors, multilateral institutions, nongovernmental organizations and the private sector must work together to strengthen the institutions needed to address information problems". Otherwise, there is a higher risk:

information capacity in globalization is raising the danger that "the poorest countries and communities will fall behind more rapidly than ever before".

On the other side, the role of bilateral cooperation and that of international geographic organizations should also focus its agenda on the need to support this "information for all " scheme, by promoting SDI activities in the emerging Regions, including spatial data production, delivery mechanisms and metadata standards.

One most important way to understand the many benefits derived from SDI is, evidently, by practicing it. At this stage of development, SDI is also an educational process ("working locally but acting globally"). Concerning the various elements involved in SDI, as for the developing nations, currently there is more training than education. This issue should be highly relevant when considering technical assistance as part of multi/bilateral cooperation agreements or when defining the agenda for the different education commissions, acting as part of the international geographic organizations. Many cases studies are showing in the developing world the existence of a tremendous gap between technology tools available and poor levels of use, to some extent, due to low availability of specialized human resources and the quality of technical assistance. Information infrastructures are the entranceway to non-limited possibilities for progress and democracy.

IV. A practical example: PC-IDEA, the availability of fundamental data for the Americas and the Global Map initiative

The concept and the processes by which Spatial Data Infrastructures (SDI) are built today are essential part of Geography around the world. The way data is being produced, organized and analyzed from local to global levels and vice versa, through initiatives like Global Map (GM), one of the pioneers in this field, results in a broad and dynamic exchange of ideas, methods, better understanding of diversity, all in sum, impacting the way territorial planning and sustainable development are pursued.

In the Americas, for the benefit of the Region and its members, PC-IDEA intends to be mature enough in a short period of time in order to play its due role in GM development and take advantage of its application. As described later on this paper, already GM Phase 1 contributes meaningfully, by increasing the amount and quality of seamless data available, without restraints, in the Americas.

There is a direct relation between PC-IDEA and Global Map.

On one side, the above mentioned 6th UNRCC for the Americas Resolution 6 on "Development of the Global Map" recommends the *"strengthening of existing efforts and the establishment of new initiatives between global mapping and various national and regional spatial data infrastructures"*.

On the other, there are the main drivers for PC-IDEA already mentioned. PC-IDEA expects to significantly stimulate the production and use of new and more powerful data sets, is the case of GM, by regional organizations and decision-making entities. Also, PC-IDEA can contribute to increase the level of participation in GM, taking into consideration that nine countries involved in PC-IDEA are not in the GM project, whilst Cayman Islands, Bermuda, Holland Antilles and Cuba are participating in GM and not yet in PC-IDEA.

-Global Map and the availability of Fundamental Data for the Americas

The situation concerning the status of seamless reference data for the Americas, available without restraints, as presented in the most recent report on "Status Maps for Cartography and Geodesy in the Americas", produced by PAIGH's Commission on Cartography (1997), concerning intermediate and small scales, can be resumed as follows:

- Regarding topographic and planimetric maps, total and homogenous coverage can only be observed in North America. A diversity of scales and partial coverage, especially in the Andean countries and the Caribbean Islands, is found in the rest of the continent. As well, a similar but more dramatic situation is observed when looking at the production of digital maps.
- Image map production is relevant in North America. There is national coverage available for Mexico, Venezuela, Guatemala and Panama. An increasing production is observed in other areas. This is the case, for instance, of Central America where this type of product is used in the recovery phase out of the hurricane "Mitch" natural disaster.
- As for vertical geodesy, coverage using conventional technology is significant for first order leveling, though there is not updated information when considering GPS based geodesy. In any case there are relevant areas, such as the Amazons, where there is not information.
- There are thematic charts covering the continent at scales ranging from 1:100.000 to 1:1.000.000. This is the case for hydrographic (including bathymetry) and aeronautical charts (Figure 2).

This few elements easily lead to the conclusion about the need for improved and accessible framework data for the Americas. Precisely, this is one of the core responsibilities for PC-IDEA and relevant work is in progress, trough the Technical Working Group (Fundamental Data Sub Group). When dealing with the issue of reference data there is global common ground but there are also relevant differences, especially when considering regional characteristics. Based on the draft document "Fundamental Data" (PC-IDEA, 2000) available for consultations by country members, differences with GM Phase 1 are located only in the incorporation of a layer for geodesy.

More relevantly, when defining GM Phase 2, differences may vary greatly as initial contributions from PC-IDEA members call for consideration of additional thematic data layers such as bathymetry, various biodiversity indicators and cadastral information, including specific aspects like Indian reservations, state parks and natural reservations. Though these motivations are related to the existence of different points of view based on cultural and geopolitical aspects, they all may enrich GM Phase 2 in its conceptualization and development stages. In any case, it is in the interest of PC-IDEA to contribute to GM vision, given the need to enhance accuracy and completeness of fundamental data for the Americas. In times of information infrastructures development, needs to reduce duplication and other cost efficiency considerations, at PC-IDEA there is understanding about the relevance of this type of data sets, in particular, because they will be accessible, documented, well structured and reliable.

-Global Map applications: The impact on project formulation and Decision-Making in the Americas

During the mentioned 6th UNRCC for the Americas, when considering the resolution to be adopted on establishment of a permanent committee on GIS/SDI issues for the Americas, the reasons mentioned by the delegates went beyond the need for a regional forum to share experiences, consult on matters of common interest or develop a regional geographic information infrastructure, behind the idea really was the need to maximize the economic, social and environmental benefits derived from geographic information.

To obtain these ambitious goals, PC-IDEA must be efficient in terms of placing new data sets for improved regional project formulation and decision- making. For instance, regardless of its economic and social short-term feasibility, a visionary mega project like IFSA, aiming at integration of main rivers in South America, is

affected by the lack of seamless multinational geographic information (CIFSA, 1999). GM will allow these kind of initiatives to advance.

Indeed, the availability of this information in a region used to a national interpretation of the Americas territory, will impact for the better the works of many regional organizations. In other words, if GM was conceived to facilitate implementation of agreements and conventions related to environmental protection, disaster mitigation and the promotion of growth in the context of sustainable development (ISCGM, 1999), there is no doubt that the main sub regional economic agreements will soon exemplify the benefits of this project.

In fact, as the majority of the decisions and in particular those market-related has a geographic dimension or are georeferenced, international agreements such as the Central American Common Market (MCCA), the Andean Community of Nations (CAN), Caribbean Community (CARICOM), among others, will immediately benefit from GM as they have requested this information for years.

Moreover, within the context of GM definition, a look at the Americas continent and the particularities observed in the various sub regions, and should induce or make evident the need for a GM Phase 2:

- The lack of appropriate seamless spatial information is directly related to the possibility to improve quality in the decision making process, concerning prevention and mitigation policy related to natural disasters. This is the case, for instance, of the South American Pacific coast in relation to "El Niño" phenomena and Central America regarding the social and economic impact of hurricanes every year.
- Tropical soils, covering 50% of South American productive lands, are affected by serious fertility limitations derived from conventional agriculture

practices. There is need for multinational spatial information related to viability of treatment options, eventually leading to increments in their productivity.

- Many of the mega diversity nations are located in South America, owning rich ecosystems of enormous biological importance. More consistent spatial information, leading to comprehensive analysis is required to conceive improved protection and adequate management policies.

V. THE FUTURE: Recommendations for Action

In view of the need for action addressed to accelerate SDI processes in the Region, the following actions are recommended:

1. Develop UN policy, by which the UN agencies and the state members, involved in the development of spatial data projects, promote national and regional sound and harmonic data infrastructures.

2. Promote the work of the Permanent Committee on Spatial Data in the Americas - PC IDEA

3. Implement training and educational activities in the context of SDI development, including specific applications related to the use of satellite imagery.

Not much work is being done in the region regarding consequences of new space imaging technologies and applications, for instance, economic and social benefits for developing nations. An exemption can be the work of SELPER, the regional ISPRS branch, as part of the preparations for UNSpace 1999. However, presentation of these issues is quite fragmented and without coherence

4. Re-engineer key aspects of the UNRCC. The situation was studied during the UNRCC Special Working Group meeting in Mexico, concluding with a proposal for the creation of a UN Permanent Geographic Information Commission. Recalling content of Resolution 2 from the 1997 UNRCC for the Americas, re-engineer also means allowing bench-marking and comparison of achievements and strategies concerning surveying, mapping, cadastral and GIS activities, and providing policy support to governments and UN system, focusing on how spatial data infrastructures can contribute to better decision-making on issues relevant to local, national, regional and global sustainable development

5. Support the works of the United Nations Geographic Information Working Group. This is the first UNRCC where this issue of importance for the UN system and the State Members can be jointly studied.

6. Obtain a more clear statement and compromise from the international geographic organizations attending UNRCCs, concerning SDI. The recent Asia-Pacific UNRCC deliberated on the subject with relevant participation from FIG and ICA. It is noted the way FIG is increasing its presence in Latin America.

7. Support specific NSDI and RSDI related pilot projects, in particular pertaining spatial data production, delivery mechanisms and metadata standards.

8. Elaborate an inventory of global data sets and initiatives. Already there are too many not really efficiently integrated global projects, related to spatial data causing a need for a more clear vision and goals.

9. Support a regional Workshop on Institutional Development and Capacity Building for National Mapping Agencies in the context of new Information and Communication Technologies and SDI.

It is a fact that these changes are impacting these organizations, not only in terms of reviewing its main functions and mission as producers of fundamental data and the need for capacity building to take advantage of these developments, but regarding the economic externalities each society can derive from this information (Groot, 2000).

SELECTED BIBLIOGRAPHY

Borrero Santiago, IGAC 1998. Case Study in SDI Transnational initiatives: Latin America. 3rd Global Spatial Data Infrastructure Conference, Canberra, Australia.

1999. Case Study at the National Level: ICDE, the Colombian SDI. Cambridge.

2000. La Infraestructura de Información Territorial (SDI): Un Desarrollo Esencial para la Sociedad del Siglo XXI. Instituto Geográfico Agustín Codazzi. Seminar on Spatial Data Infrastructures and the Workshop on Metadata.

2000. Formation of the Permanent Committee on SDI for the Americas – CPIDEA: A Report. 15th UN Regional Cartographic Conference for Asia - Pacific.

Canadian Geospatial Data Infrastructure –CGDI. The Geospatial Standards Thrusts of the Canadian Geospatial Data Infrastructure. URL http://www.cgdi.gc.ca

Comité Permanente para la Infraestructura de Datos Espaciales de Las Américas - CP IDEA, 2000. Estatutos. URL www.igac.gov.co/cpidea

2000. Acta de Conformación. Seminario Internacional: Infraestructuras Nacionales De Datos Espaciales, Bogotá, Colombia.

Holland Peter. The Strategic Imperative of a Global Spatial Data Infrastructure. General Manger.

Infraestructura Colombiana de Datos Espaciales -ICDE. Acta de Acuerdo. 2000. Políticas Generales para el Intercambio de Información Geográfica. URL www.igac.gov.co

2000. Reglamento Operativo.

Instituto Geográfico Agustín Codazzi. 1999. Infraestructura Colombiana de Datos Espaciales "Conceptos y Lineamientos".

National Spatial Data Infrastructure NSDI. Federal Geographic Data Committee. Framework. Introduction and Guide. www.fgdc.org

The World Bank. 1998/99. World Development Report. Knowledge for Development. Oxford University Press. ISSN 016-5085.